INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2018

Subject ST9 – Enterprise Risk Management

Introduction

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

Luke Hatter
Chair of the Board of Examiners
July 2018

A. General comments on the *aims of this subject and how it is marked*

1. The aim of the Enterprise Risk Management (ERM) subject is to instil in successful candidates the key principles underlying the implementation and application of ERM within an organisation, including governance and process as well as quantitative methods of risk measurement and modelling. The student should gain the ability to apply the knowledge and understanding of ERM practices to any type of organisation.

2. The ST9 exam generally requires bullet point form or short form essay style answers that apply general principles to directly address specific circumstances. The answers given below are just one possible set of acceptable answers.

3. Candidates are awarded marks for all reasonable answers including different but still reasonable numerical solutions. Marks are awarded for working in the case of numerical answers.

4. Candidates' answers are made up of a series of points. For example, a point can be stating a valid type of risk, describing the type of risk or (part of) a calculation.

5. Candidates who give well-reasoned points, not in the marking schedule, are awarded marks for doing so.

B. General comments on *student performance in this diet of the examination*

Many students performed well in this diet. This is reflected in the pass rate, which is higher than in some previous diets. There were two main areas that candidates lost marks. First, many candidates struggled with bookwork questions. There were several questions where a good knowledge of bookwork would have gained full marks, and even a cursory knowledge would have gained many of the marks available. The second area where some candidates struggled was in generating a sufficient range of ideas. Parts (viii) and (ix) of question 1 are a good example of this. The point here is that it is easier to generate a good number of ideas If the range of areas covered is as wide as possible.

C. Pass Mark

The Pass Mark for this exam was 60.

Solutions

Q1

(i)

- Internal processes [½]
- People [½]
- Systems [½]
- External events [½]

> *This bookwork question was well-answered, with a majority of candidates scoring full marks.*

(ii)

- Easy to calculate [½]
- It can be calculated using a number of different approaches. [½]
- It considers not only whether a particularly likelihood of loss would result in insolvency… [½]
- … but also the distribution of losses beyond that point. [½]
- Unlike VaR… [½]
- … it is a coherent measure… [½]
- … i.e. it behaves sensibly when loss distributions are altered or combined. [½]
- It gives credit for diversification between risks. [½]
- However, it has little intuitive meaning / hard to explain. [½]
- And it is not easy to relate to the current value of a portfolio. [½]
- It is also difficult to model as it focusses on tail events. [½]

[Max 3]

> *This question was moderately well answered, although very few candidates scored all the marks available.*

(iii)

- One month is a short time period [½]
- May be exposed to the risk for more than one month [1]
- Impact or cost of risk may not materialise fully in one month [1]
- On the other hand, it is more difficult to assess the probability of loss over a month than over a shorter time period… [½]
- … due to lack of independence of loss events… [½]
- … and their ability to recur [½]
- Regulatory capital requirements may be risk-based, and the regulator may require a different time horizon… [½]
- … so it could be more efficient to use the same time horizon for both external and internal reporting [½]
- Shareholders may be interested in profit variation over a longer time period [½]
- Small franchises, so might not be able to do monthly reporting [½]
- Seasonality [½]

[Max 3]

This question was also moderately well answered, although very few candidates scored all the marks available.

(iv)

- The individual franchise owners may be best placed to identify and assess their own top five operational risks, as they know their specific branch best [1]
- Providing a standard list should help with identification of key risks [½]
- However, allowing full individual choice of top five risks could lead to inconsistencies between franchises [½]
- There should be many operational similarities between branches… [½]
- … so it may be more effective for BBs to identify the key operational risks centrally [½]
- but different franchises may operate very differently… [½]
- …so key risks may be different [½]
- Since expected shortfall is a coherent risk measure… [½]
- … it can be aggregated across the franchises [½]
- Providing a standard probability table ensures some consistency [½]
- However, it may not be appropriate for each individual franchise [½]
- The whole business may be exposed to parameter risk from the standard table [½]
- Expected loss is not included in what is provided, so has to be determined by each franchise individually [1]
- Each franchise may not have the data [½]
- ...or skill to do this effectively [½]

[Max 4]

This question was reasonably well answered, with most candidates receiving more than half the marks available. More marks would have been scored if a wider range of points had been made.

(v) **Advantages**

- It is simple to apply [½]
- The approach is consistently applied across the franchises [½]

Disadvantages

- The top five risks may not cover a material proportion or 80% of the operational risks [1]
- So the 25% uplift is not appropriate in terms of total aggregate loss [½]
- The top five risks may not be representative of the remaining risks [½]
- So the 25% uplift may not be appropriate in distribution [½]
- The approach makes no allowance for diversification or interactions between risks [1]
- It assumes that risks are fully independent … [½]
- … which is unlikely [½]

[Max 4]

This question was also reasonably well answered, with most candidates receiving more than half the marks available.

(vi)

- Pearson's rho is widely used… [½]
- … and easy to calculate [½]
- So there may be existing industry wide or national data already [½]
- Pearson's rho is impacted by the actual values of the data [½]
- Unlike rank correlation coefficients [½]
- So requires accurate data [½]
- It is not clear if BBs has enough relevant and accurate data to calculate it reliably [1]
- It is only valid as a correlation measure when the data series are jointly elliptical (half mark for "normal") [1]
- It is not clear that this is the case for BBs' operational risk events [½]
- But operational risk tends to be more skewed [½]
- Operational risk events include high severity low frequency events… [½]
- ... So may be more appropriate to use a copula [½]
- ... Since the relationship will vary… [½]
- … particularly in the tail [½]

[Max 5]

This question was poorly answered, with a number of candidates scoring no marks at all. Marks would have been available for showing only a slight knowledge of the characteristics of Pearson's rho.

(vii)

- The risk function should report into the board rather than to the compliance manage [½]
- Or BBs should appoint a Chief Risk Officer who is a member of the board [½]
- The board must set the risk appetite, rather than the risk function doing so [1]
- The risk management function should work closely with the board to understand the risk appetite [½]
- Risk appetite should be considered not just for each risk category in isolation, but in aggregate across all risks [½]
- It may be appropriate to consider other risk types… [½]
- … e.g. may also need a liquidity risk manager [½]
- The risk management function must be engaged all year, not just six months [½]
- Could do this part-time to avoid doubling costs [½]
- Risk assessment and reporting should be more frequent than annually… [½]
- … e.g. quarterly [½]
- In particular, breaches should be identified immediately rather than only once a year [½]
- May need to hold conferences to get everyone together or regular webex/telephone calls/video calls to engage with franchises [½]
- Risk reports should be shared with / explained to franchise owners [½]

- The risk management function needs to define how governance works in crises situations [½]
- BBs could consider bringing the risk management function in-house (if it can secure the expertise) [½]
- Improved communication between risk function and franchises [½]

[Max 6]

This question was reasonably well answered, with most candidates scoring more than half the marks available.

(viii)

- Improve training for staff, e.g.
  - Health and safety
  - Food hygiene,
  - First aid
  - Money laundering
  - Customer service. [1]

[Note to markers – give ½ mark for "training", full mark for any appropriate example.]

- Purchase insurance including:
  - Buildings insurance (for flood, fire, other external events)
  - Business continuity insurance
  - Public liability/legal insurance [1]

[Note to markers – give ½ mark for "insurance", full mark for any appropriate example.]

- Put a disaster recovery and/or business continuity plan in place [1]
- Improved controls and checks on processes [1]
- Improved controls and checks on systems including:
  - Alarm systems
  - Regular maintenance
  - Backup systems [1]

[Max 3]

This question was not generally answered well, with a number of candidates failing to score any marks. Given the range of options that would have resulted in marks being awarded, this was poor.

(ix)

- Time taken to implement [½]
- Cannot implement immediately [½]
- Need to review and update regularly [½]
- Need to repeat for new staff [½]
- Cost of performing training/implementing changed process [½]
- Cost of additional systems [½]

- Cost of insurance premium [½]
- Staff time required for training, away from business [½]
- Residual risks… [½]
- … e.g. introduction of counterparty risk (insurance) [½]

[Max 3]

Again, this question was not well-answered, with too few ideas being generated.

(x)

- Relationship management accountability and coordination [1]
- Identify people responsible for engaging with the regulator [½]
- And for maintaining list of key contacts within the regulator [½]
- And for analysing the relationship / maintaining relationship development plans [½]
- Governance around data submitted to the regulator [½]
- Timeline for regular interactions and submissions to the regulator [½]
- Senior management visibility [½]
- Clear process/plan/logistics management for regulator site visits [½]
- Development of positive perception of supervisors internally within the company [½]
- Proactive and early engagement [1]
    - Respond to any consultations/surveys within deadlines [½]
    - Respond in as much detail as possible [½]
    - ...including pros, cons and practical considerations [½]
    - Responding promptly to investigations, data requests, etc. [½]
    - Identification of opportunities for engagement [½]
    - Including monitoring supervisory priorities, objectives and pressure points [½]
    - Provide constructive feedback on proposals… [½]
    - … without feeling pressure to comment on every aspect [½]
    - Process for lobbying for change in a supervisor's policy position [½]
    - Including whether better to use an industry body rather than going directly to the regulator [½]

- Communication transparency [1]
    - Early notification of any issues/potential breaches [½]
    - Early notification and involvement in strategic decisions – e.g. takeovers, change of business *(any other relevant example)* [½]
    - Responses to queries include all relevant data even if not requested [½]

- Alignment with supervisory objectives [1]
    - Any strategic decisions include consideration of supervisory objectives [½]
    - Timelines for responses to regulatory recommendations [½]

- Presentation and enhancement of corporate reputation [1]
    - Governance around public statements [½]
    - Adopt best practice before mandated [½]

[Max 6]

This question was also answered only moderately well, with few candidates scoring highly. Again, a good range of points was needed to score well.

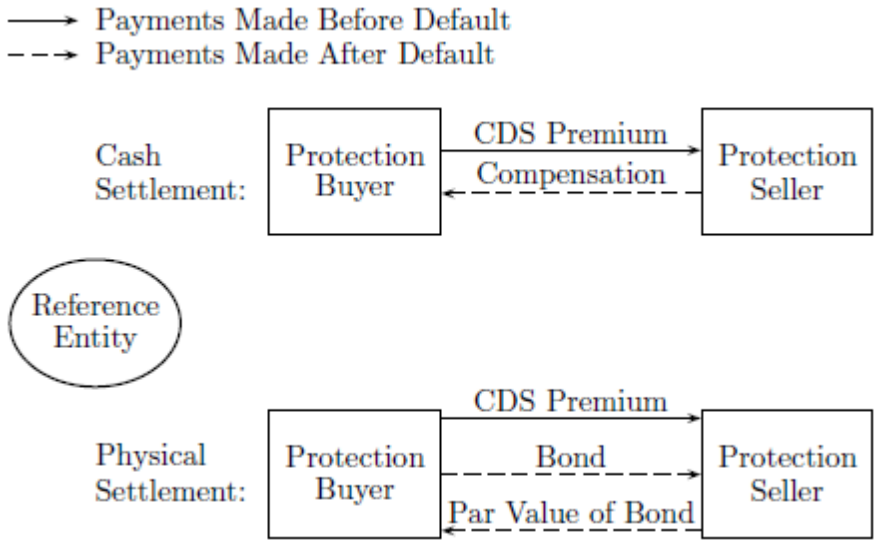
Q2

(i)

- A CDS can be settled either for cash ("cash settlement")… [½]
- …or with the transfer of the underlying bond ("physical settlement") [½]

Almost half of the candidates scored full marks on this question, but more than one in five scored no marks at all. This is a bookwork question, so full marks should be achievable.

(ii)



[2 marks for each correct diagram; deduct a half mark for each error or omission.]

Whilst a number of candidates scored full marks on this question, as many scored no marks. Most candidates were able to score reasonably well here.

(iii)

- The CDS may not cover the full deficit [½]
- E.g. because the size of deficit may change when the sponsor becomes insolvent [½]
- Or because it cannot be purchased in sufficient quantity [½]
- Liquidity risk from time taken for CDS to settle once a default has occurred [½]
- Liquidity risk in relation to marketability of the CDS / ability to close it out early if required [½]
- Potential lack of availability of new CDS when this one expires [½]
- Credit/counterparty risk of investment bank [½]

- Basis risk: the bond CDS may not pay out under exactly the same circumstances in which the company would default on the pension scheme [½]
- Risk of dispute over definition of "default" [½]
- New operational risk is introduced [½]
- e.g. wrong trade put on – wrong expiry, wrong amount, wrong name (any example) [½]
- Risk arising from potential lack of expertise in derivatives management [½]
- Expense risk: under-estimation of additional expenses relating to management of the CDS [½]
- Regulatory risk: e.g. change to accounting/regulatory treatment of CDSs [½]
- Longevity risk is not affected, so remains with the pension scheme [½]
- As does investment risk [½]

[Max 5, max 1 mark for non-CDS related points]

This question was moderately well answered.

(iv) **Financial market risk**

- Maximum equity allocation of 30% of total assets [½]
- Maximum emerging market equity allocation of 10% of total assets [½]
- Maximum allocation to real estate of 20% of total assets [½]
- No allocation to derivatives [½]
- Short-term liquidity – projected cash inflow over subsequent month 10% higher than projected cash outflow [½]
- Medium-term liquidity – projected cash inflow over subsequent twelve months 20% higher than projected cash outflow [½]

Operational risk

- No major administration errors in any 12-month period [½]
- No more than 20 minor administration errors in any 12-month period [½]

Overall funding level

- Ten-year… [½]
- … 95% confidence level ... [½]
- … Value at Risk… [½]
- … of 100% [½]

[Max 5]

This question was well answered, with many candidates scoring full marks

(v)

- Sponsor credit rating [½]
- Diversification of equities within broader classes [½]
- Maximum allocation to overseas equities [½]
- Maximum (or no) equity allocation to specific economies/countries [½]
- Maximum allocation to any single corporate bond [½]

- Maximum credit rating for corporate bond holdings [½]
- Statement that all bond holdings will be domestic (if aim is to continue as now) [½]
- Maximum level of duration mismatch between assets and liabilities [½]
- Maximum acceptable level of administrators' IT systems downtime [½]
- Maximum level of data errors [½]
- Maximum acceptable level of administrators' staff turnover rates [½]
- Maximum credit rating for any outsourcing companies used [½]
- Maximum acceptable exposure to longevity risk [½]
- Extent to which other (non-derivative) risk mitigation techniques are acceptable… [½]
- … e.g. ART, longevity bonds [½]
- Maximum probability of funding level falling below 100% over shorter than 10 year time period (or "probability of ruin") [½]
- Tail Value at Risk metric [½]
- Ease of measuring/monitoring each requirement [½]
- Frequency at which each needs to be met/checked [½]
- Robustness under stress tests / scenario tests [½]
- Governance and accountability structures [½]
- Values/ethics/culture [½]
- Existing risk management expertise and practices [½]
- Level of transparency required [½]
- Other policies/procedures [½]
- Descriptions need to be clear… [½]
- … and unambiguous [½]

[Max 7]

This question was poorly answered, with candidates failing to generate the number and range of points required. As in other parts of this paper, the key to this type of question is to generate answers in as wide a range of areas as possible.

(vi)

- They refer to the amount of additional assets or cash flows… [1]
- … required to cover unexpected events [1]
- …to a specified measure of risk tolerance… [1]
- …with risk being measured in some way [½]
- …. over a specified time horizon [1]

[Max 3]

This question was not well answered, with one in five candidates failing to score. This is essentially a bookwork question, so the failure to score any marks is poor.

Q3 (i)

- Insurance risk: risk of higher than expected claims [1]
- E.g. risk of excessive loss from unusually bad weather events (e.g. floods, wind, etc.) [½]
- E.g. risk of prolonged bad weather from climate change [½]
- E.g. risk of excessive loss from disease [½]
- Adverse selection – policies can be taken out with no underwriting [1]
- Concentration risk: since all policies are in the same area [1]
    - so exposed to the same bad weather events [½]
    - could also adversely affect the value of lending to local businesses [½]
    - If very bad, could also adversely affect value of domestic equities and bonds [½]
    - diseases could spread across area covered [½]
- Credit/counterparty risk
    - In corporate bonds and local lending
    - In relation to tree nurseries as brokers
    - In relation to provider of replacement trees

  [1 for 1st point made, ½ for 2nd and 3rd points]

- Equity value risk [½]
- Currency risk in non-domestic bonds [1]
- … and potentially in domestic equities, depending on businesses [½]
- Interest rate risk in relation to asset/liability duration mismatch [1]
- And dependent on whether lending is at fixed or floating rates [½]
- Liquidity risk – may not have income/cash flows when needed [½]
- Operational risks: risk of administrative errors [½]
- E.g. problems paying claims (under Compensation Policy) / collecting premiums [½]
- E.g. problems with record keeping / personal data leakages etc. *(any examples)* [½]
- Risk of higher than expected expenses [½]
- Risk of lower than expected new business/renewals… [½]
- … due to poor economic conditions… [½]
- … e.g. individuals unable to continue paying premiums [½]
- Risk of loss of business due to competitors… [½]
- … due to having better pricing… [½]
- … or better service *(any examples)* [½]
- Reputational risk: e.g. if poor service… [½]
- … or poor replacement trees provided (under Replacement Policy) [½]
- Strategic risk: appears to be a very narrow business model [½]
- Risk of regulatory/legal changes with adverse impact [½]

[Max 10]

This question was generally well answered.

(ii)

- Reinsurance [1]
- Weather derivatives [½]
- Only insure certain types of tree / exclude those that are prone to specific diseases [½]
- Higher reserves / capital [1]
- Margins in pricing [½]
- Introduce underwriting [½]
- Extend insurance sales into other areas of the country [1]
- … or even to different countries [½]
- Lend to businesses in other areas [½]
- Global investment portfolio [½]
- Invest in government bonds only [½]
- Or above a certain credit rating [½]
- Maximum holding in any specific counterparty [½]
- Use credit default swaps (or other credit derivatives) [1]
- Perform due diligence on other counterparties [½]
- Hold deposits/balances in relation to broker premiums [½]
- Diversify non-bond investments [1]
- Use equity options / currency derivatives [½]
- Invest in domestic currency only [½]
- Close asset/liability duration matching [1]
- Match profile of short-term cash inflows and outflows (liquidity) [1]
- Hold sufficient liquid asset (e.g. cash) reserves [½]
- Clear operational processes [½]
- And staff training [½]
- Possibly use administrative outsourcing [½]
- Expense controls [½]
- Monitor competitor activity [½]
- Improve premium rates [½]
- Improve service levels [½]
- Diversify into other types of insurance business [½]
- Lobby / keep pace with regulatory changes / use legal expertise [½]

[Max 10]

This question was generally well answered.

(iii)

- It may be assumed that there is more likelihood of fraudulent claims from those taking out Compensation Policies, as these pay out cash, so these are more expensive. [1]
- It may be because TreeSure believes that it can replace a damaged tree more cheaply than a policyholder would be able to, so the Replacement Policies are cheaper. [1]
- Might be more popular so can charge more [½]
- (or) Might be a unique product [½]

[Max 2]

This question was well answered, with one in five candidates scoring full marks.

(iv)

- The claim rate for Replacement is 10%, whilst for Compensation Policies is 20% [½]
- Therefore the claim rate for Compensation Policies is twice that for Replacement Policies [½]
- This is out of line with the 10% price differential… [½]
- … suggesting that the Compensation Policies may be loss-making. [½]
- This suggests that there is an element of adverse selection… [1]
- …perhaps meaning that as many as half of the Compensation Policy claims are suspicious [½]
- It seems that the 10% discount is not sufficient to attract potential fraudsters away from taking out Compensation Policies [1]
- It is also worth noting that the number of Compensation Policies sold outnumbered the number of replacement policies by 7–3… [½]
- … so the number of potentially fraudulent policies as a proportion of total policies is high (maybe 35%?) [½]
- … and similarly the proportion of potentially loss-making policies is high [½]

[Max 4]

This question was reasonably well answered.

(v)

- Increase discount on Replacement Policy / increase premium on Compensation Policy [1]
- Withdraw Compensation Policy from sale [1]
- Introduce warnings on penalties for fraud [1]
- Impose restrictions on renewal following a claim [1]
- Add an excess/cap/limit on benefit [1]
- Introduce a no claims discount [1]

[Max 3]

This questions was well answered by many, but whilst some candidates scored full marks, an equal number scored no marks.

(vi)

- The introduction of underwriting appears to have reduced the relative attractiveness of Compensation Policies… [½]
- …as a lower proportion of the applications are for these policies (6–4 from 7–3)…[½]
- …and a lower proportion of compensation quotes (33%) result in policies than replacement quotes (75%) [1]
- As a result of underwriting, more Compensation Policy applicants may be being offered significantly higher premiums than Replacement Policy applicants [1]
- … which would support suspicions about anti-selection / potential fraud [½]

- However, the claim rate for compensation policies is still slightly higher than for replacement policies (12.5% vs 10%) [1]

[Max 3]

This question was well answered, with many candidates scoring full marks.

(vii)

- Fitting all available data to a distribution means that all data points are used, thus improving the fit.
- The lognormal distribution permits only positive values, so is appropriate for modelling wind speeds.
- It is also easy to model and to analyse

However:

- It is limited in the range of distribution shapes that it can produce.
- It assumes that moderate wind speeds are relevant to the distribution of extreme wind speeds, which might not be the case.
- The method does not concentrate on the tail of the distribution, which is most relevant.
- The lognormal distribution is fat-tailed, and it is not clear whether this is relevant.

[1 mark per point for the first two valid points, then ½ mark for each subsequent valid point]

[Max 3]

This question was reasonably well answered.

(viii)

- Extreme value theory approach [½]
- E.g. Generalised Pareto distribution [½]
- Using a threshold of 100mph [½]

[Max 1]

This question was well answered, with almost half of the candidates scoring full marks.

END OF EXAMINERS' REPORT